CHAPTER 5

SURVEYING AND MAPPING

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5.1 GENERAL.

This chapter presents general requirements for surveying and mapping, as well as the processing of the data that may be required for the work necessary in the design and advance planning of the project. All labor, materials, and equipment necessary to perform site surveying and mapping services is required. Adequate professional supervision and quality control must be provided to assure the accuracy, quality, completeness of the site surveys.

5.2 APPLICABLE PUBLICATIONS.

The following pukblications may be applicable for site surveying and mapping for the design of the project.

5.2.1 Standards Manual for U. S. Army Corps of Engineers.

EM 1110-1-1003	NAVSTAR Global Positioning System Manual, dated Sept.1990.
EM 1110-1-1000	Photogrammetry Manual.
EM 1110-1-1001	Geodetic Control.
EM 1110-1-1005	Topographic and Field Surveying and Mapping.
EM 1110-2-1003	Hydrographic Surveying, dated August 1990.

5.2.2 Technical Manual for U. S. Army Corps of Engineers.

TEC-1110-1-147	CORPSCON.

Manual of Instructions for Geodesy,Catrography,Hydrography and Photogrammetry for the Mobile District, dated January 1988.

The Engineering Manuals (EM's)listed above shall take precedence over District Manuals.

5.3 PROJECT DEFINITION.

5.3.1 General Statement of Surveying and Mapping Services.

The designer shall submit a general statement (scope of work) as to what type surveying and mapping services shall be required for the site plan (if applicable). The following information is required:

a. Name and location of the project.

b. Type of surveying and/or mapping services (geodetic, topographic, hydrographic, route location surveys, etc.).

c. English or metric surveys.

d. Site map to scale showing area to be surveyed (acres, length of route location survey, etc.). Scale required for the new survey (1"=30', 1"=50', 1"=100', 1"=200', etc.) and contour interval (1', 2', 5', etc.).

e. General description of utilities (above and/or underground) that shall be located (if applicable).

5.3.2 Existing Horizontal and Vertical Site Control.

The Government shall upon request, furnish all pertinent horizontal and vertical control data on file. The following information is required when making a requests.

a. Location and name of the project.

b. General site map of the project area showing location and coordinate values (NAD27 or NAD83).

Existing site control (horizontal and vertical) shall be requested from the Corps of Engineers at the following address:

U. S. Army Engineer District, Mobile
Attention: CESAM-EN-MS
Post Office Box 2288
Mobile, Alabama 36628-0001

5.4 CONCEPT OF SURVEYING AND MAPPING SERVICES.

The following surveying and mapping services may be necessary in the design and advance planning of the project:

5.4.1 Geodetic and Control Surveys.

Includes surveys in which the figure and size of the earth are considered and is used for precise location of basic points suitable for controlling other surveys. Includes 1st, 2nd, and 3rd order horizontal and vertical control surveys, geodetic astronomy, gravity, and magnetic surveys in accordance with the Standards and Specifications for Geodetic Control Networks published by the Federal Geodetic Control Committee dated September 1984. Conventional, electronic instrumentation, inertial, satellite and other survey methods, as applicable, may be utilized.

5.4.2 Topographic Engineering and Construction Surveys.

Includes acquisition of topographic surveying and mapping data representing three dimensional spatial relationships on the earth's surface. This data may be required for planning, cost estimating, engineering, design, construction, master planning, operations, and recording as-built conditions. Conventional and electronic instrumentation, remote sensing, inertial, satellite and other survey methods, as applicable, may be utilized.

5.4.3 Topographic.

To be accomplished either by plane table and/or Total Station with Data Collector.

5.4.4 Route Location Surveys.

Roads, railroads, levees, channels, etc.

5.4.5 Quantity Surveys.

Preconstruction and/or final cross sections and computations of quantities.

5.4.6 Layout Surveys.

Staking of buildings, structures, utilities, roads, railroads, etc.

5.4.7 Hydrographic Engineering and Construction Surveying.

Surveys of channels, lakes, rivers, bays and open coastal waters in support of engineering design, construction, and operations and maintenance. Includes acquisition of hydrographic and surveying and mapping data representing three dimensional spatial relationships on the earth's surface. This data may be required for planning, cost estimating, engineering, dredging, design, construction, sedimentation, master planning, operations and as-built conditions period, conventional and electronic instrumentation, and remote sensing, inertial, satellite, side scan sonar, subbottom profiling, marine magnetometer, and other surveying methods, as applicable, may be used.

5.4. 8 Precise Surveys.

First, second, or third order horizontal and vertical surveys to monitor movement of structures or precise location of structures.

5.4.9 Boundary and Cadastral Surveying.

Includes property, boundary and easement surveys, etc. Conventional, electronic instrumentation, inertial, satellite, and other survey methods, as applicable, may be utilized.

5.4.10 Photogrammetric Services.

Includes acquisition of surveying and mapping data from measurement of photographs representing either three dimensional or planimetric spatial relationships on the earth's surface. Stereo plotting, bridging, photographic laboratory, and reproduction services, acquisition of aerial photography, drafting, and scribing. Photogrammetric mapping to include film negatives, film and glass positives, photo indexes, photo enlargements, computations, scribecoats, compilation histories, and mapping on stable base materials may be required.

5.4.11 Supplemental Map Control (SMC).

Establishment of third order horizontal and vertical control on photo identifiable points for Photogrammetric mapping.

5.4.12 Cartographic Surveying.

Includes acquisition and assimilation of topographic and/or hydrographic surveying and mapping data for preparation of maps, charts, and similar products for planning. Conventional and electronic instrumentation, inertial, satellite and other survey methods, as applicable, may be utilized.

5.4.13 Mapping and Charting.

Includes the preparation (i.e., design, compilation , digitizing, scribing, drafting, and printing) of map and chart products. These depict man-made and natural features of a part to the surface of the earth in their correct positions and at an established scale relative to a coordinate reference system. These maybe associated with engineering, land/boundary, geodetic and/or cartographic surveys. Conventional, electronic, or computer assisted design & CADD systems as applicable may be utilized.

5.4.14 Digital Data.

Survey data is required in Intergraph IGDS 3D design files and TTN Files compatible with Intergraph ESP InRoads & InSite software or AutoCad digital files compatible with the Mobile District's AutoCad (v 13) System. The Designer shall store and maintain a copy of all electronically created digital files (CD's, tapes and disc, etc.) through the construction phase of the project. These files shall be made available to the government upon request and shall be maintained with no additional cost to the Government.

5.5 MINIMUM TECHNICAL STANDARDS FOR SURVEYING AND MAPPING SERVICES.

5.5.1 Registered Land Surveyor.

All surveying and mapping services shall be accomplished under the direction/supervision of a Registered Land Surveyor in the State in which the project is located. Site plan mapping shall be signed and sealed with the following statement: "I HEREBY STATE THAT THIS SURVEY AND DRAWING(S) MEETS OR EXCEEDS THE MINIMUM TECHNICAL STANDARDS FOR THE PRACTICE OF LAND SURVEYING IN ALABAMA, FLORIDA, GEORGIA, MISSISSIPPI OR TENNESSEE".

5.5.2 Horizontal and Vertical Datum.

All site plan surveying and mapping shall be referenced (tied) to the Local State Plane Coordinate System (NAD27 or NAD83) and the National Geodetic Vertical Datum (NGVD29) with no less than third (3rd) order accuracy and procedure. Assumed coordinates and vertical positions can be used only with the Government's permission. Design drawing(s) shall indicated what horizontal and vertical control datum was used for the site surveys.

5.5.3 Survey Monuments.

A minimum of three permanent survey monuments shall be established on or adjacent to the design site. Survey monuments must be established in areas that shall not be disturbed prior to and during the construction phase of the project. Designation and date established shall be stamped on each survey monument. No less than third order horizontal and vertical control shall be established on each survey monument. A detailed description with horizontal and vertical datum shall be indicated on the site plan survey and design drawings. The following are requirements for a survey monument:

a. Be composed of a durable ferrous or magnetic material with minimal length of eighteen inches and cross-section area of material of 0.3 square inches.

b. Be identified with durable marker or cap bearing designation, date and Registration Number of the land surveyor in responsible charge.

c. Be detectable with conventional instruments for finding ferrous or magnetic objects.

5.5.4 Site Plan drawing(s).

All permanent survey monuments established on site shall be shown on the final design drawings. Inserts on the drawings and/or digital files shall show a detailed sketch of the location with description of the permanent monuments established on site. Course chart on the drawings shall show coordinate and vertical values of each permanent monument.
The following is a example of a course chart:

NAME OF PROJECT AND LOCATION

DESIGNATION OF POINT	TYPE MARK DATE	NORTHING NAD27	EASTING NAD27	ELEVATION NGVD29
21A-3B	CONC. MON, 1994	345,123.34 (ME)	1,234,456.00(ME)	234.56 FT.
21A-3C	REBAR	345,140.66	1,234,400.56	246.98 FT.
BB-3	REBAR	345,340.45	1,234,645.14	76.33 M
21A-3D	CONC. MON 1994	345,450.98	1,234,823.34	77.45 M
212-3	3/4" IRON ROD	345,003.45	1,234,700.98	224.21 FT.
		NAD83	NAD83	223.78 FT
212-4	3" PVC PIPE (WE)	256,234.67(AW)	1,989,067.00(AW)	225.90 FT

5.5.5 Compliance with Applicable Laws.

All personnel shall strictly observe the laws of the United States or other governing body affecting operations at all sites. The personnel shall comply with all applicable laws under which they are operating including those concerning the inspection and operation of equipment and the licensing of Engineers, Land Surveyors, pilots, mechanics and other personnel. It is further understood and agreed that the Designer assumes full responsibility for the safety of his employees, plant, and materials.

5.5.6 Security Clearance.

If so indicated in the Statement of Work, personnel working on the project shall be capable of obtaining a temporary security clearance. The following information is required: Full Name, Position, Social Security Number, Date of Birth, Place of Birth, Security Clearance, Citizenship, Drivers License Number and State of Drivers License. Include with this list the name and phone number of a point of contact in case of an emergency. It is the responsibility of the designer to assure all personnel used can obtain the clearance.

5.6 DESIGNER'S RESPONSIBILITY FOR UNSATISFACTORY SITE SURVEYS.

If the site surveying and mapping services are found to be in error prior to and through the construction phase of the project, the designer shall be responsible for all cost in connection with correcting such errors. The designer shall be and remain responsible to the Government in accordance with applicable law for all damages to the Government caused by negligent performance of any services.

5.7 TECHNICAL REQUIREMENTS.

The Designer shall adhered to the Manual of Instructions for Geodesy, Cartography, Hydrography and Photogrammetry for the Mobile District, dated January 1988, for all surveying mapping services and can acquired from:

U. S. Army Engineer District, Mobile
Attention: CESAM-EN-MS
Post Office Box 2288
Mobile, Alabama 36628-0001